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SiPMs for Belle II ARICH

Detectors used in high energy physics experiments will need to keep sufficient performance during a few years of data-taking, despite the accumulation of radiation damage, which, for example, in the planned upgrades of the LHCb and Belle II experiments, is estimated at about 10^{13} 1-MeV neutron equivalent/cm^2 by detector end-of-life. In this work, 6 NUV-HD-RH silicon photomultiplier (SiPM) samples developed by the Fondazione Bruno Kessler (FBK) with the purpose of improving the SiPM radiation hardness were characterized before and after irradiation. Each sample has 3 wire-bonded 1x1 mm^2 15 μm pitch SiPMs with different structures. In total, **18 SiPMs**, 6 SiPMs of the same structure, were characterized **before irradiation**. 5 of the samples were irradiated at the JSI TRIGA reactor with different fluencies: **10^9 neq/cm^2**, **10^{10} neq/cm^2**, **10^{11} neq/cm^2**, **10^{12} neq/cm^2** and **10^{13} neq/cm^2**, while leaving one of the samples non-irradiated for crosscheck. In total, **15 SiPMs**, 5 SiPMs of the same structure, were re-characterized **after irradiation**. The sample irradiated at **10^9 neq/cm^2** was annealed at room temperature and its **3 SiPMs** (one per structure) re-characterized after **1 month of annealing**. For the SiPM characterization in all the cases, I-V curve measurements, threshold scan, and waveform analysis, including single photon time resolution, were carried out at room temperature and at different controlled temperature steps down to liquid nitrogen temperature.

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